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## **Lumps in the System: A Mumps Outbreak Story**

*A Factual and Fictional Case Study in Assessment  
Mid-America Regional Public Health Leadership Institute Year 15 Fellows*

### **WiWILD Team**

**Diane Christen** – Director of Operations, Wisconsin Division of Public Health

**Kelli Jones** -- Minority Health Officer, Wisconsin Division of Public Health

**Jan Klawitter** – Public Affairs and Training Manager, Wisconsin State Laboratory of Hygiene

**Debbie Konitzer** – Health Officer, Oconto County (WI) Health and Human Services

**Jackie Ove** – Health Officer, South Milwaukee (WI) Health Department

**Kitty Rahl** – Public Health Nursing Director, Eau Claire City-County (WI) Health Department

**RoAnn Warden** – Assistant Director, Green County (WI) Health Department

**Millie Jones, Mentor** – Family Health Clinical Consultant, Wisconsin Division of Public Health

### **Abstract**

In December 2005, two college students in the Midwest were diagnosed with mumps – the first two cases in what would become the largest mumps outbreak in the United States since 1991. By October 2006, 45 states and the District of Columbia reported 5,783 cases of mumps, with 54% of cases classified as confirmed, 45% as probable and 1% unknown (*MMWR Weekly, Oct.27, 2006 [55(42); 1152-1153]*).

The mumps virus spread from its epicenter in the Midwest state of “Maize” to surrounding states, including the state of “Fromage”, which had its first confirmed mumps case on March 20, 2006. By mid-May 2006, the Fromage State Health Laboratory (FSHL) would suspend its serological mumps testing because of concern about testing accuracy.

This factual and fictional case study will examine the evolution of the mumps outbreak in the state of “Fromage” in the context of the core function of **Assessment** and its essential public health services of “Monitoring health status to identify community health problems,” and “Diagnosing and investigating health problems and health hazards in the community.” The time frame will focus primarily on the March – May 2006 period, which saw the highest level of mumps activity in Fromage. The case study will focus on how decisions made and information distributed at the state level both helped and hindered the ability of local health departments around the state of Fromage to serve their communities. And it will tell the story of what happens when a disease that’s rarely seen shows up in a highly vaccinated population and needs to be diagnosed by a test that’s rarely performed.

## **Case Study**

### **Background**

In December 2005, two students at Northeastern Maize State University went to the student health center complaining of fever, head and muscle aches and general malaise. The chief physician at the health center also noticed the students had swelling in their parotid salivary glands causing their cheeks to swell near their jawlines. The physician collected parotid duct swab samples from the students and sent the samples off to the Maize Public Health Laboratory for viral culture. Test results came back positive for mumps virus. Little did the physician know that the outbreak had begun.

Since 2001, the United States has averaged a reported 265 mumps cases a year (range: 231-293) (*MMWR Dispatch, March 30, 2006 [55(13);366-368]* ). College campuses are a perfect breeding ground for viruses such as mumps which are spread by respiratory and oral secretions due to the communal living, dining, studying and recreational areas. As college students mix with community members, travel home, visit friends at other schools, etc., the virus can spread far beyond the site of the original infection.

The vaccination requirements of colleges and universities vary. One dose of the MMR (measles-mumps-rubella) vaccine can prevent approximately 80% of mumps cases, while two doses can prevent about 90% of cases (*CDC National Immunization Program Mumps web site <http://www.cdc.gov/nip/diseases/mumps/faqs-outbreak.htm>*). So even if a school requires two doses of the MMR vaccine, the virus can still occur and spread -- just not as widely. This is true of the general population as well. It's also speculated that the vaccine might be less effective in preventing asymptomatic infection than the classic parotitis mumps. Persons with asymptomatic mumps are capable of spreading the infection to others (*MMWR Dispatch, May 18, 2006 [55(Dispatch);1-5]* ).

Adding to the difficulty of tracking and containing mumps outbreaks is the fact that the disease is so rarely seen. Many physicians, nurses and public health professionals have never seen a case of mumps and might dismiss the diagnosis in a vaccinated person. Also, up to 30% of persons infected with mumps never show signs of parotitis and can have non-specific symptoms similar to many other respiratory infections. Laboratory serological testing for a disease in a highly vaccinated population like the United States is also problematic. A vaccinated person may not produce antibodies that indicate a recent mumps infection even though they have the disease. Hence serological mumps testing cannot be used to rule out a case of mumps. It's clear that the health care and public health sectors have their work cut out for them.

### **The Outbreak in Fromage**

While the mumps outbreak was beginning to ramp up in Maize, it didn't really hit Fromage until March 2006. Staff at local health departments had been following the outbreak in Maize via the news media. Some sent alerts to their local health care providers offering information on mumps from the Maize State Health Department web

site. On March 20, 2006, the Fromage State Health Laboratory (FSHL) would report the first positive test result for mumps.

In early April 2006, the Fromage State Health Department (which is separate from the FSHL) would send local health departments a mumps Frequently Asked Questions sheet along with information on collecting patient blood for IgM serologic testing at the FSHL. Wanting to err on the side of not missing cases and realizing that only 30% of mumps cases actually have the characteristic swelling, the Fromage State Health Department defined a suspect case as anyone with an upper respiratory infection. This meant health care providers sent a large number of specimens to the FSHL for testing and many of these patients did not have mumps. This resulted in the probability of obtaining a “true” positive test result to be much less.

In late April the State Health Department issued a news release about the mumps situation in Fromage and recommended vaccinations for those unvaccinated for mumps. In early May, the State Health Department updated the FAQs and continued to post to their web site information related to Fromage’s outbreak with national recommendations.

It became clear that there were four major issue areas in the Fromage mumps outbreak – laboratory testing, schools/daycare centers, physicians/infection control practitioners and the media.

### **Laboratory Testing**

Just as mumps is a disease rarely seen by health care providers, the mumps IgM test is rarely performed by laboratories. Also, there is no standard mumps serological test that has been well validated, so different state laboratories use different test kits. The National Public Health Laboratory performs a test created in-house by its scientists. This lack of test uniformity and validation, combined with the lack of baseline data on the true prevalence of mumps in the population because it is so rarely seen, makes it difficult to track outbreaks and determine true case numbers.

FSHL began receiving specimens for mumps testing in March 2006, with its first positive mumps result on March 20, 2006. The initial testing algorithm called for health care providers to submit urine specimens and buccal (inside cheek) swabs for culture testing. While culture is the gold standard for mumps testing, its diagnostic sensitivity is only 30%.

For this reason, health care providers were encouraged to also submit blood serum specimens for IgM and IgG testing. In mid-April 2006, FSHL brought on-line a DNA-based real-time PCR test for mumps. This molecular test provides results in hours rather than days. PCR testing is more sensitive than either culture or IgM testing. The downside is that it’s a more expensive test to perform. However, the rapid results and increased sensitivity allow for better control and management of outbreaks.

Many health care providers submitted specimens for culture/PCR and IgM testing for each patient. In the first week of May 2006, Fromage State Lab scientists noticed a worrisome trend in the test data. Of specimens from patients submitted, only 3 patients were positive for mumps by culture/PCR testing, but 177 patients were positive by IgM testing. Since the culture/PCR testing combination should be detecting more than 30% of infected individuals, the scientists were worried that more people were being called “positive” for mumps than actually were. They asked the Fromage State Health Department to correlate the IgM results with patients’ clinical data received from the patients’ physicians. The positive IgM test results and the clinical data *appeared* to correlate based on the information the State Health Department was receiving. However, FSHL scientists still had their suspicions.

Also during the first week of May, the FSHL received calls from a few physicians suggesting there might have been false positive IgM test results reported for their elderly patients since the patients had no symptoms of and no exposure to mumps.

FSHL began an investigation. Scientists tested 30 serum specimens collected during the summer of 2005 (when no mumps was present in Fromage) from patients suspected of having a mosquito-borne virus. Nineteen of the 30 specimens tested positive for mumps by IgM testing. It was clear – the IgM test could not be trusted. The FSHL also contacted the National Public Health Laboratory to alert them to the issue and ask for assistance in the investigation.

The FSHL consulted with the State Health Department and scientific leaders at the two agencies agreed that the State Lab should suspend its IgM serology testing due to a concern about false positive test results. The State Health Department sent a memo to all local health officers and infection control practitioners explaining that the Fromage State Lab was suspending IgM serology testing for mumps, but that patient specimens should still be submitted for PCR and culture testing, which are reliable test methods. The State Lab also sent the memo to all hospital and clinic laboratories in the state. The memo was also posted on Fromage’s password-protected Health Alert web site.

In their conversations with mumps experts at the National Public Health Laboratory, scientists from the Fromage State Lab were told that the National Lab was hearing from other state labs that they were also seeing false positive tests results from their IgM testing (although no state other than Fromage had suspended this form of testing yet). After deciding to suspend the IgM testing, FSHL sent a number of its IgM-positive mumps specimens to the National Lab for further testing. The National Lab found that less than half of the Fromage specimens were positive for mumps by the National Lab’s in-house test method. The National Lab was also conducting follow-up testing on specimens from other states that had expressed concerns about false positive test results. The National Lab verbally acknowledged there were discrepancies between the number of positive test results derived from those states’ test methods and the National Lab’s method. The problem in Fromage was being experienced in other states, too. This investigation continues.

### **Schools/daycare centers**

With the first positively diagnosed case of mumps in Fromage, the local public health departments responded by **assessing** the at-risk populations of daycare and school attendees and staff. The impact that this vaccine-preventable disease could have on a daycare or school is great given the incubation period, communicability of the disease and that 30% of the population can be infected and be asymptomatic. Thus, not only were local health departments concerned with the vaccinated population, but of greater concern were those that had not been vaccinated at all or had not been adequately vaccinated, as isolation and quarantine could occur up to 25 days post exposure.

Public Health Nurses **assessed** vaccination records of daycare attendees and students of public and parochial schools. Staff at these facilities were asked to report history of disease or vaccination status also. In accordance with Fromage Administrative Code HFS 145 Control of Communicable Disease, a letter was drafted and sent home with attendees and staff of all daycares and schools explaining the disease, the incubation period, signs and symptoms, and especially the need for vaccination of susceptibles if the child or adult had been previously unvaccinated. This letter also explained the procedure for isolation and quarantine if persons not adequately protected were exposed to a suspect, probable, or confirmed case, and for close contacts to a case.

Local health department staff reinforced with key personnel, school attendance secretaries, school principals and daycare directors the importance of reporting suspected or possible cases to the health department.

### **Physicians/Infection Control Practitioners**

As medical and infection control practitioners became aware that mumps was in the neighboring state of Maize during March 2006, the **assessment** process began within the local communities. Individuals who were coming into the clinics and emergency rooms with signs and symptoms of mumps were being tested for mumps with IgM and IgG serological tests and instructed by their health care provider to remain isolated. In addition they were told that someone from their local health department would be contacting them with more information. Infection control practitioners (ICP) and health care providers started collecting the necessary patient information for the mumps worksheet or communicable disease reporting form and then forwarded this information on to the health departments. Local health departments proceeded to follow-up on the suspect mumps cases reported.

As new information was coming from the Fromage State Health Department in late April and May 2006 regarding mumps testing recommendations, isolation/quarantine and re-vaccinating, it was passed on to the local health care providers. Many ICP's and physicians were invited and tuned into the mumps teleconference updates put on by the Fromage State Health Department. Local health officers routinely forwarded to local health care providers and ICP's the emails and correspondence from the state health department as well as checking the Health Alert web site for new information that

covered the mumps outbreak. Physicians primarily wanted to know what tests should they run and where should they send the samples for the testing. Infection Control Practitioners relied on the state and local health departments for getting this needed information out to their physicians and facilities.

ICP's and physicians were not as confident in their understanding of the state's and the National Public Health Department's recommendations on who should be vaccinated or revaccinated for health care workers and teachers. The recommendations from the national level were different than those of the Fromage State Health Department. In the past, ICP's could accept the employee's word if they knew they had ever had mumps. Now employees were being required to have lab work done to determine their immune status for mumps if they were not adequately immunized or if they were born before 1957.

On May 11, 2006 the Fromage State Health Department announced that the Fromage State Health Laboratory was suspending the IgM and IgG serology testing for mumps because of their concern over testing accuracy. The announcement came with very clear and concise recommendations for health care providers and ICP's to follow.

Billing issues also arose in some areas because some insurance companies would not cover the cost of specimen collection for patients who were being screened for mumps. Patients were being billed for the uncovered charges even though the laboratory testing was being done on the recommendation of the State Health Department.

### **Media**

Within five days of receiving the initial notice of the Maize outbreak, Clear Water County in West Central Fromage received its first media inquiry about local mumps status and implications for the community. The health officer provided a television news interview on April 11, 2006 to report there had been no case of mumps locally and to provide information about mumps disease, signs and symptoms and vaccination as a preventive measure.

Nine days later, the Southern Big City Health Department recommended that all colleges and universities in the Southern Big City metro area set up special mumps vaccination clinics to update vaccinations for all college students. The action was reported in the *Southern Big City Gazette*. This was followed a day later by a Fromage State Health Department news release regarding the Midwest mumps outbreak.

In Clear Water County, these stories raised concerns among students at the University of Fromage-Clear Water campus. A campus newspaper reporter contacted the local health department for information. The health officer provided information about the disease, signs and symptoms, the importance of updated vaccination and referred the reporter also to the director of the local student health services. The story headlines were "***Mumps Mayhem in Midwest: Disease is making appearances even among vaccinated.***" The

health officer and the Student Health Services Director coordinated media messages on an ongoing basis.

By May 5, 2006, Clear Water County received reports of two laboratory-confirmed cases of mumps in the county. The health officer provided interviews to television and newspaper reporters. The local newspaper's front-page headline that evening boldly stated, "***Mumps Confirmed: Infectious Disease Spreads to Clear Water County.***" The media messages emphasized and accurately reported were: (1) the cases were not related and their sources of exposure were unknown; (2) the county health department was working closely with all health care providers; and (3) up-to-date immunization is an important protection.

On May 6, 2006, a campus newspaper reporter again approached the health department for information for a follow-up story to educate concerned students. The published article was entitled "***Experts Say Mumps No Reason for Alarm: Viral Disease reaches area for first time since '90s.***" The article identified the emergence of mumps as a concern but not a reason for alarm. Key points included the importance of vaccination, respiratory hygiene and seeking medical care if symptomatic.

Community and media interest subsided when case counts remained at two over a two-week period. No further cases were identified in Clear Water County. The local media did not pursue stories about suspension of mumps IgM testing.

## **Conclusions/Areas for Improvement**

Based on the experiences related in this case study:

1. The identification and required reporting of communicable disease is a very effective assessment/surveillance system when health care providers and infection control practitioners are informed in a timely manner with up-to-date recommendations and guidelines from the health departments (state and local). In order for public health to do their job of **assessment** and "monitor health status to identify community health problems" and "diagnosis and investigate health problems and health hazards in the community" it is critical that they have a good partnership/relationship with their clinics and ICP's. Having an established contact person, like an ICP, within the clinics and hospitals who can act as a conduit for the sharing of information back and forth was very effective in this mumps outbreak.
2. Local Health Departments need clarification for payer source for specimen collection if the testing is being done for screening/epidemiological purposes. Testing can be done at the State Laboratory fee-exempt, but who covers the costs of specimen collection? As noted in *Healthiest Fromage 2010*, one of the core principles and values that support the transformation of Fromage's public health system is, "All Fromage residents deserve a basic level of health services. Improved individual and community health will happen when basic health

- services are affordable for all and access does not depend on race, cultural heritage or geographic location.”
3. The authority for the control of communicable disease comes from Fromage Administrative Code HFS 145 Control of Communicable Disease; however, there is confusion surrounding the health officer's ability to isolate and quarantine an unvaccinated or inadequately vaccinated individual. A clear answer as to the authority to follow through on that process was never established from the State Health Department and continues to be an unanswered question for local health officers.
  4. Local health departments rely on the State Health Department to provide clear, consistent and timely information about the situation. Delay on the part of the State can force local health departments to take independent action and release their messages and intervention recommendations before the State.
  5. When it became clear that other states were also experiencing problems with their mumps IgM testing, federal-level leadership was needed to address the issue.

### **Study Guide questions**

In responding to these questions, consider the assessment data presented in the case study and identify any assurance and policy development actions that are needed to improve the next outbreak response.

1. What is the impact when local health departments put out information independent of each other and the State?
2. What might the State Health Department do to promote the release of timely and consistent information?
3. How do states handle billing during outbreak situations regardless of insurance coverage? Are these guidelines developed in advance or on a case-by case basis?
4. What is the impact on local health departments and health care providers when disease testing is suspended? What can happen when one state suspends testing due to concerns about test reliability and other states that might have the same concerns do not?
5. How does a local leader apply the five leadership practices when implementing state recommendations that can present challenges and barriers at the local level, for example recommending proof of vaccination by educators, health care workers and other high-risk adults?
6. What leadership principles from Dr. Louis Rowitz’s book do you believe were illustrated by this case study?